(12) UK Patent Application (19) GB (11) 2 363 744 (13) A

(43) Date of A Publication 09.01.2002

(21) Application No 0104824.8

(22) Date of Filing 26.02.2001

(30) Priority Data
(31) 20035167 (32) 24.06.2000 (33) KR
(31) 20035168 (32) 24.06.2000

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(51) INT CL[7]
B04C 5/26 , A47L 9/16

(52) UK CL (Edition T )
B2P P1A P10B2A3 P10B2B P10B2C
A4F FFD

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(58) Field of Search
UK CL (Edition S ) A4F FFD , B2P P1A P10B2A3
P10B2B P10B2C
INT CL[7] A47L 9/16 , B04C 5/26
Online: WPI JAPIO EPODOC

(54) Abstract Title
**An upright cyclone vacuum cleaner**

(57) An upright-type vacuum cleaner includes a cyclone type dust collector (15) to collect contaminants from the air drawn in through a suction brush. The cyclone-type dust collector includes a cover (20), first and second cyclone receptacles (30, 40), and a lower closure (50). The first cyclone receptacle (30) separates by centrifugal force and collects large particle contaminants. The second cyclone receptacle (40), disposed inside the first cyclone receptacle (30), separates and collects small particles and includes a grille having a plurality of fine holes (41a), through which air from the first cyclone receptacle (30) flows into the second cyclone receptacle (40). The lower closure (50) provides access to the contaminants collected in the first and second cyclone receptacles (30, 40). A reverse flow prevention section (33, 51) is also provided to prevent reverse flow of contaminants from the lower closure (50).

A further cleaner is claimed having a cyclone air exhaust pipe that can act as a handle.

FIG.2

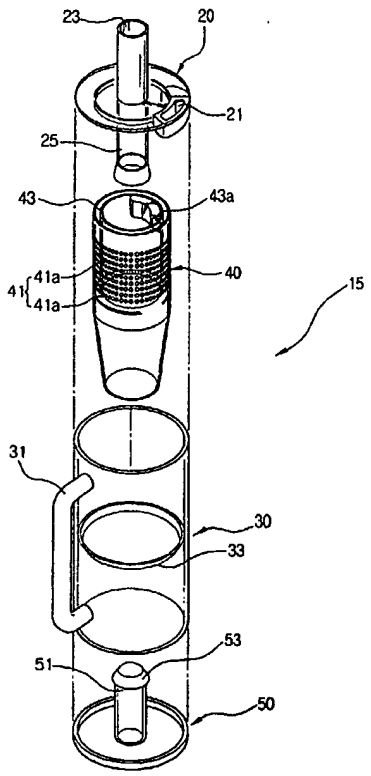


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FIG. 1

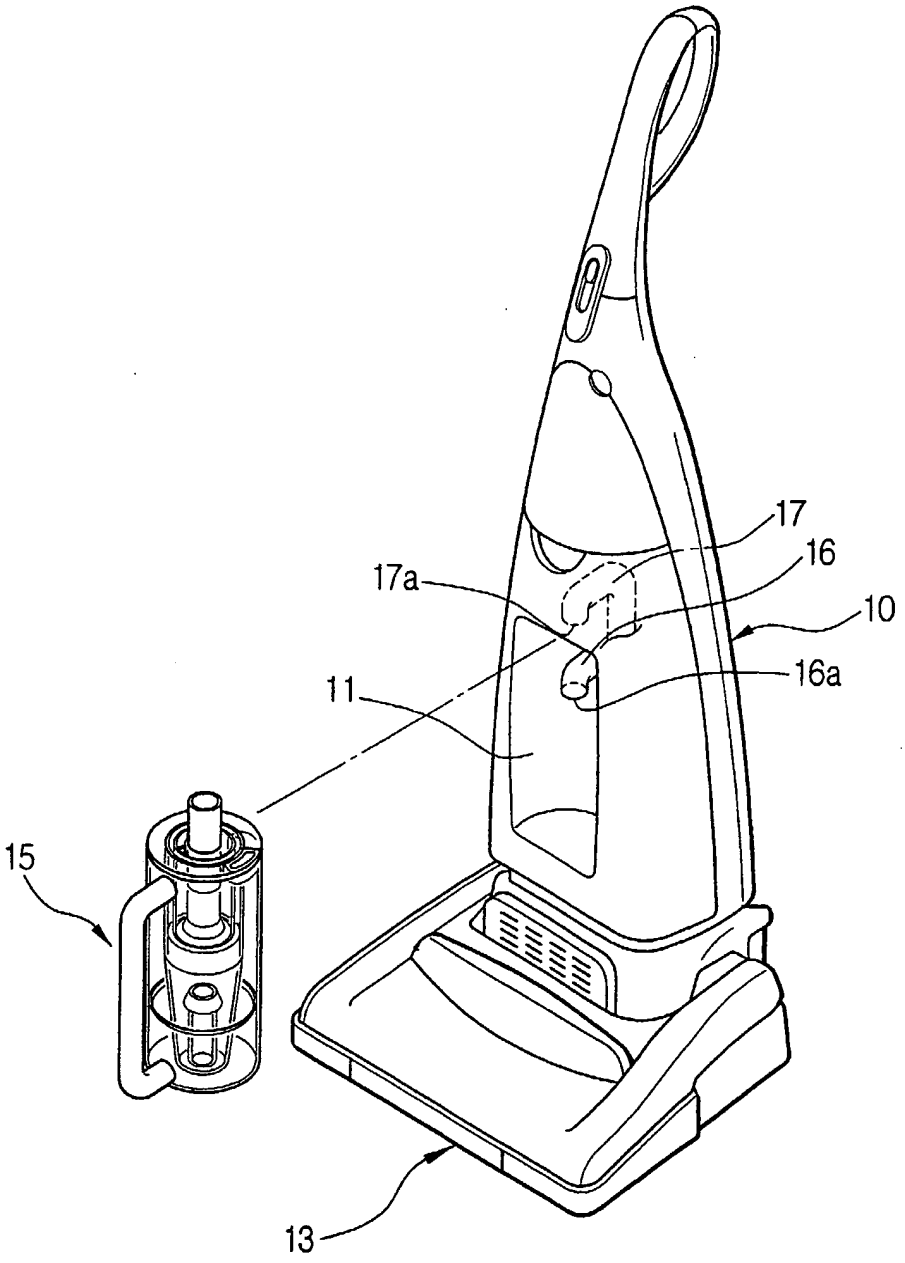


FIG.2

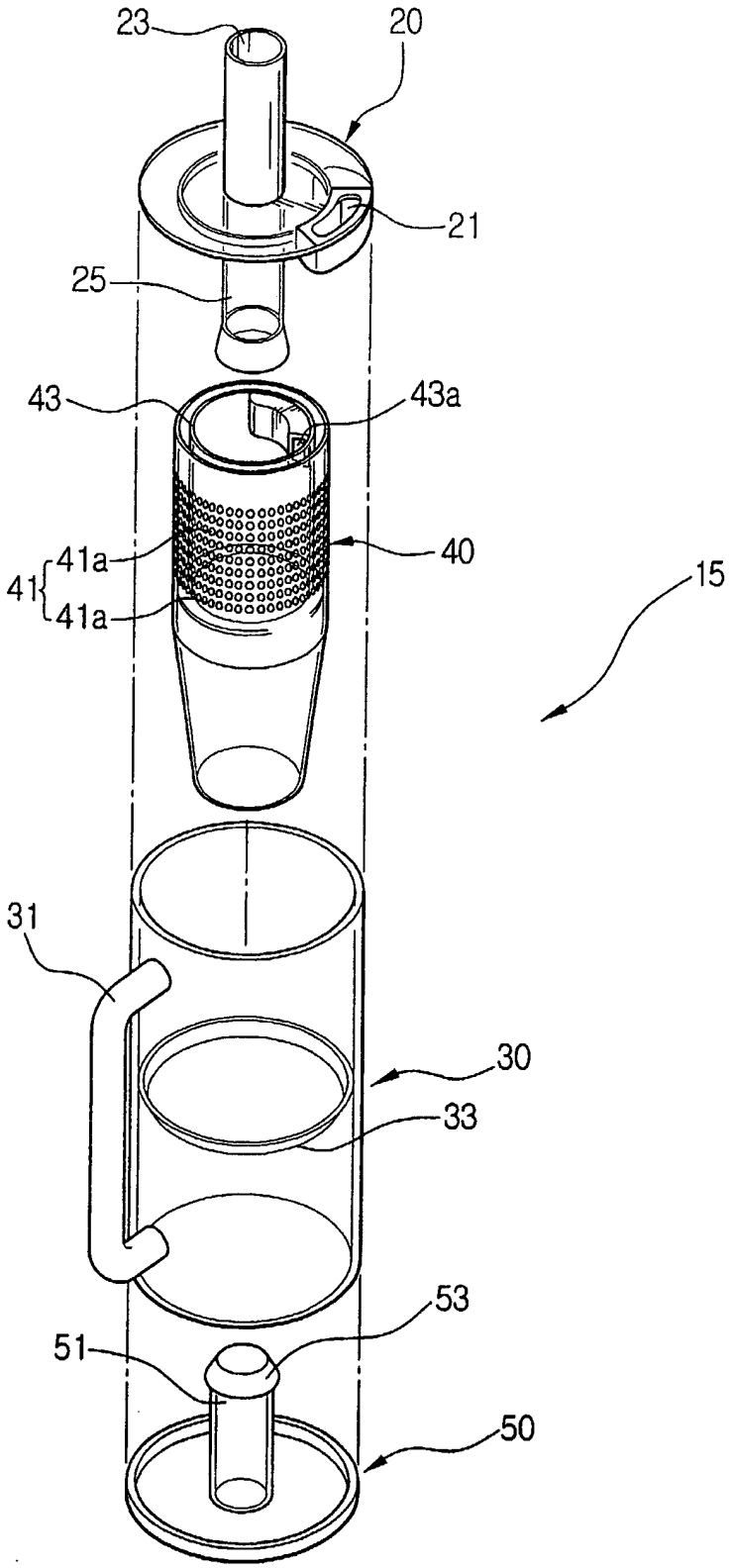


FIG.3

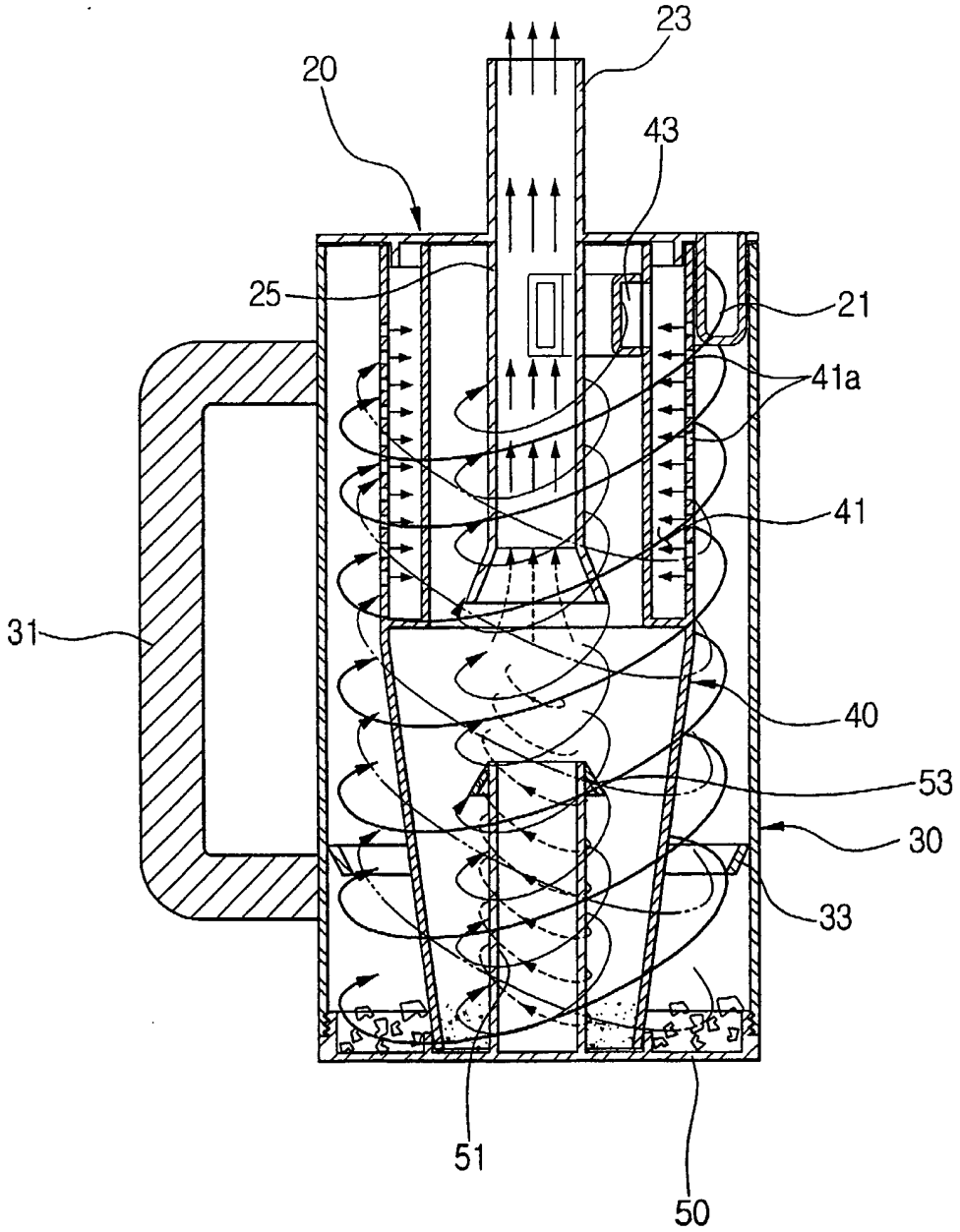


FIG.4

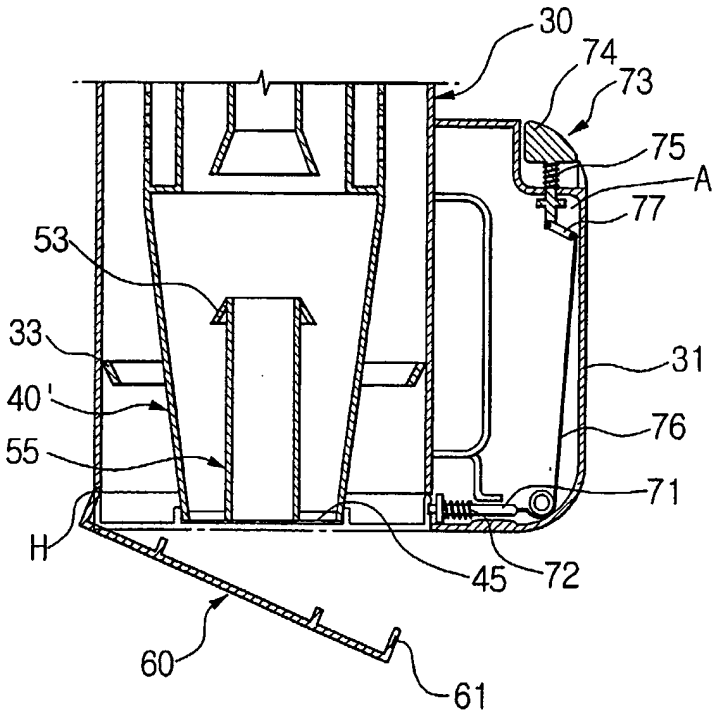


FIG.5

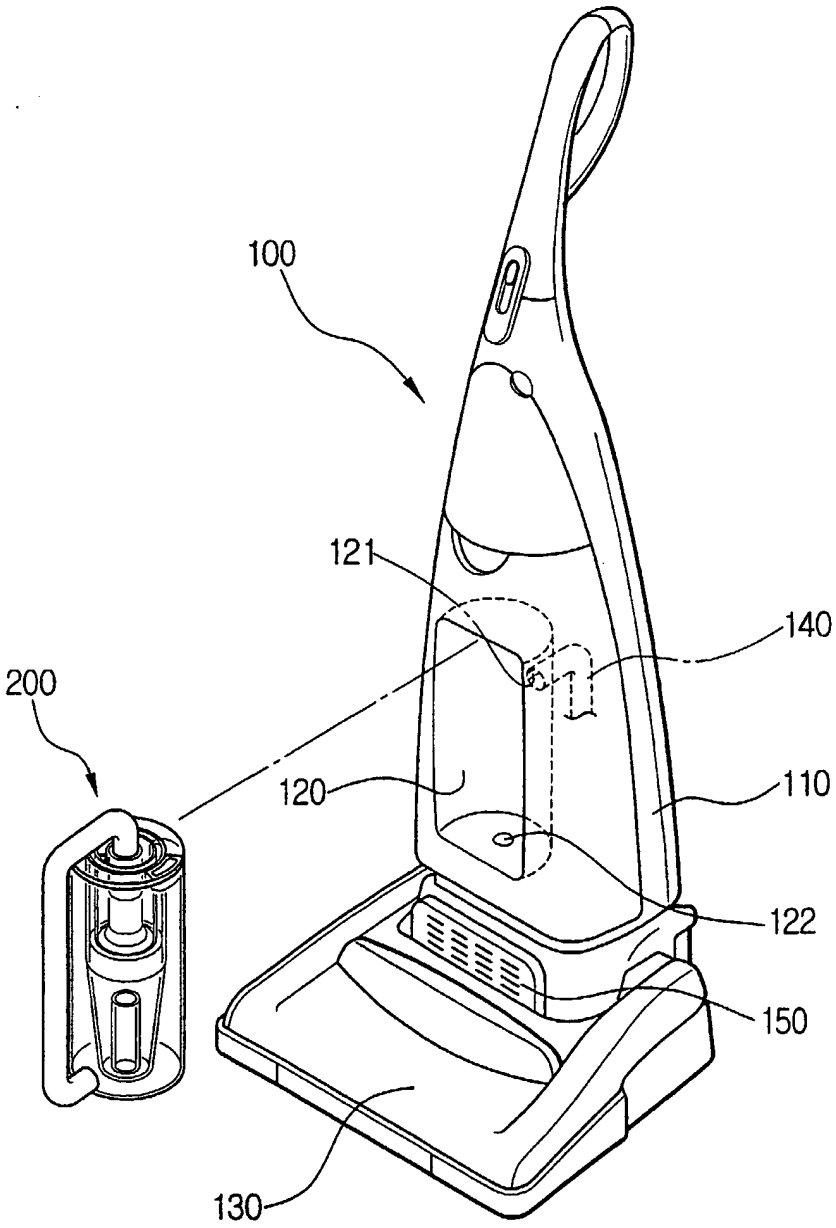


FIG.6

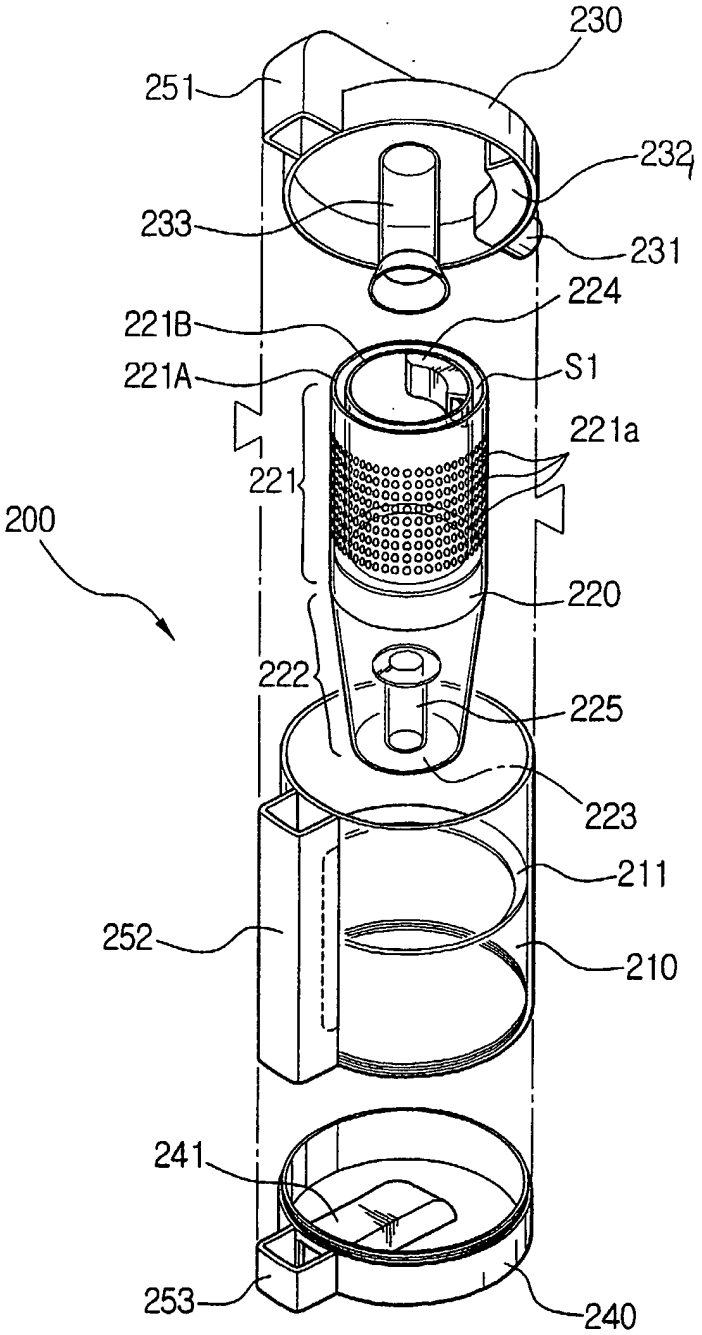
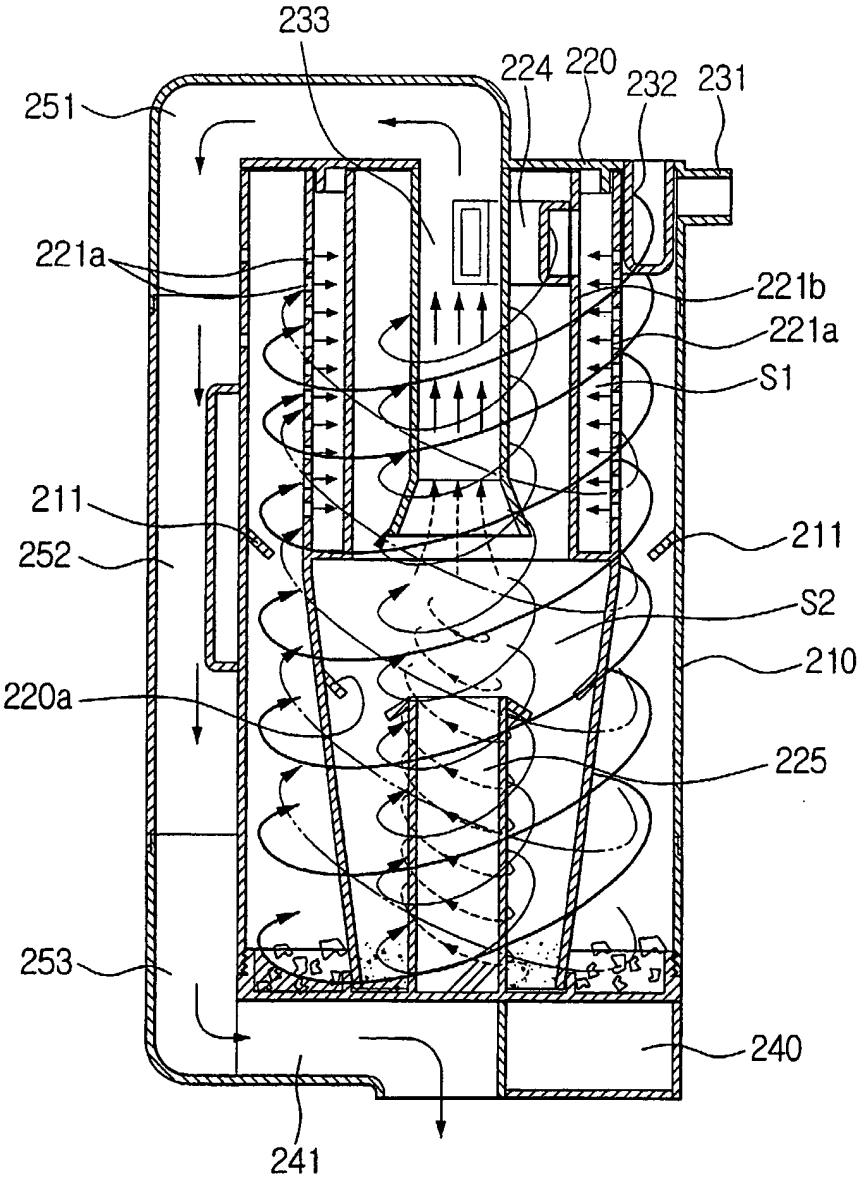

230
251
232
233
231
224
221B
221A
S1
221a
221
200
220
222
225
223
211
252
210
241
253
240

FIG.7


233
224
220
232
231
251
221a
221b
221a
S1
211
211
252
S2
210
220a
225
253
240
241

# UPRIGHT TYPE VACUUM CLEANER HAVING A CYCLONE-TYPE DUST COLLECTOR

The present invention relates to an upright type vacuum cleaner, and more particularly, to an upright type vacuum cleaner having a cyclone type dust collector capable of separating by centrifugal force and collecting minute particle dust and large particle contaminants from the air that is drawn in through a suction brush or suction head of the vacuum cleaner.

Generally, an upright type vacuum cleaner includes a suction brush disposed at an end of a vacuum cleaner body for movement across a cleaning surface. An inner space of the body is divided into a dust chamber and a motor chamber. A dust filter is removably disposed in the dust chamber and a motor is disposed in the motor chamber.

When the motor operates, a strong suction force is generated at the suction brush, the suction force drawing contaminants through the suction brush and into the cleaner body. Once inside the cleaner body, the air passes through the dust filter, in the dust chamber, and is discharged out of the cleaner. During this process, dust and dirt contaminants in the air are filtered out at the dust filter. Accordingly, a user has to provide additional filters for replacement. In addition, the dust filter must be replaced manually, which can be unhygienic for the user.

It is an object of the invention to provide an improved upright type vacuum cleaner having a cyclone type dust collector for separating by centrifugal force and collecting minute particle dust and larger particle contaminants from the air drawn in through a suction brush of the cleaner.

According to a first aspect of the invention, an upright-type vacuum cleaner comprises: a body having a dust chamber and a motor chamber; a suction brush connected to the body; and a cyclone type dust collector removably disposed in the dust chamber. The

cyclone type dust collector, which separates and collects dust and contaminants from the air that is drawn in through the suction brush, includes a cover, first and second cyclone receptacles, and a lower closure or closure. The cover has a first air inlet connected to a suction hose, which in turn is connected to the suction brush and the dust chamber, and an air outlet, which is connected to an exhaust hose. The exhaust hose is connected to the dust chamber and the motor driving chamber. The first cyclone receptacle is connected to the cover and induces the air from the first air inlet into a vortex, using the centrifugal force of the vortex to separate and collect larger particle contaminants from the air. The second cyclone receptacle is disposed in the first cyclone receptacle in a manner such that the second cyclone receptacle is also connected to the cover. The second cyclone receptacle includes a grille having a plurality of fine holes, through which air rising from the bottom of the first cyclone receptacle flows, and a second air inlet to guide the air from the fine holes of the grille into a vortex. The lower closure is removably mounted on a lower open end of the first cyclone receptacle to permit access to the contaminants collected in the first and second cyclone receptacles, thereby facilitating disposal of the contaminants. The cyclone type dust collector further includes a reverse flow preventing section for preventing a reverse flow of the contaminants from the lower closure.

The reverse flow preventing section includes an annular main rib protruding from an inner circumference of the first cyclone receptacle.

The reverse flow preventing section further includes a reverse flow prevention pipe, which protrudes from a lower central part of the second cyclone receptacle, and a sub-rib protruding from an outer circumference of the reverse flow prevention pipe for preventing a reverse flow of the contaminants. The main rib is advantageously downwardly inclined towards the lower closure.

The sub-rib integrally extends from an upper end of the reverse flow prevention pipe radially and is downwardly inclined toward the lower closure.

The grille includes a plurality of fine holes formed in an outer wall of the second cyclone receptacle, with each fine hole being spaced apart by a predetermined distance from adjacent fine holes.

The cyclone type dust collector further includes a hinge shaft for hinging a side of the lower closure to a lower side of the first cyclone receptacle, and a locking and unlocking section for locking and unlocking the other side of the lower closure to and from the first cyclone receptacle.

The locking and unlocking section includes a locking groove formed in the lower closure, a locking rod movably disposed in the first cyclone receptacle to engage the locking groove, a first pressing member for biasing the locking rod towards the locking groove, and an unlocking unit for disengaging the locking rod from the locking groove, by overcoming the biasing force of the first pressing member.

The unlocking unit also includes an unlocking button disposed on a side of the first cyclone receptacle, a second pressing member for biasing the unlocking button outwardly; a wire, one end of which is connected to the locking rod, and a pivot member. One end of the pivot member is connected to the wire, and the other end is connected to the unlocking button to disengage the locking rod from the locking groove.

The locking and unlocking section is formed in a handle which is disposed on an outer circumference of the first cyclone receptacle.

According to a second aspect of the invention, an upright type vacuum cleaner comprises: a body having a dust chamber and a motor chamber; a suction brush connected to the vacuum cleaner body and interconnected to the dust chamber through a connecting tube; a cyclone type dust collector detachably disposed in the dust chamber for separating by centrifugal force and collecting dust and contaminants from the air that is drawn in through the suction brush. The cyclone type dust collector includes: a first cyclone receptacle, substantially cylindrical in shape having two open

ends; a second cyclone receptacle coaxially disposed within the first cyclone receptacle with a predetermined space therebetween; a cover for covering upper ends of the first and second cyclone receptacles; a base for covering the lower ends of the first and second cyclone receptacles; and an air exhaust pipe for interconnecting the second cyclone receptacle with the motor driving chamber.

Here, the cyclone type dust collector further includes an annular reverse flow prevention rib protruding from an inner circumference of the first cyclone receptacle towards a central axis at a predetermined sloping angle. It is preferable that the reverse flow prevention rib is downwardly inclined, i.e. towards the base.

The cover may include a tube provided along the inner circumference of the dust chamber, the tube communicating with a connecting channel which communicates with the dust chamber. An inflow pipe extends radially a predetermined distance along a ceiling part and an inner circumference of the cover. The inflow pipe is connected to the tube. The cover further includes a suction pipe extending a predetermined depth from a centre of the ceiling of the cover. The suction pipe is connected to the exhaust pipe.

The suction pipe has a funnel-like shape, and has a free end portion extending radially from the suction pipe, gradually increasing in diameter from the main diameter of the suction pipe.

The second cyclone receptacle is substantially cylindrical in shape and has a plane upper side, a tapered portion gradually decreasing in diameter from the diameter of the cylinder, and a bottom side for covering one end of the second cyclone receptacle. The plane upper side has a dual structure formed of an outer body having a plurality of fine holes uniformly formed therein, and an inner body disposed within the outer body at a predetermined distance from the outer body. The bottom side has a guide tube protruding from the centre to a predetermined height of the second cyclone receptacle.

The cyclone type dust collector further includes an air outlet formed in an upper end of the inner body of the second cyclone receptacle. The air outlet has an opening that partially overlaps with an opening of the inflow pipe of the cover.

The cyclone type dust collector further includes a guide tube extending radially in a diagonal or generally circumferential direction for inducing the air from the air outlet into a vortex.

It is also preferable that the exhaust pipe includes a first exhaust sub-pipe, a second exhaust sub-pipe, and a third exhaust sub pipe. The first, second and exhaust third sub-pipes are respectively formed on the outer surfaces of the cover, the first cyclone receptacle, and the base, and are interconnected.

The second exhaust sub-pipe may be spaced apart from the first cyclone receptacle so as to serve as a handle for the dust collector

The base is removably connected to the first cyclone receptacle.

The invention will now be described by way of example with reference to the drawings, in which:

Figure 1 is a perspective view of a first upright-type vacuum cleaner having a cyclone type dust collector, in accordance with the invention, the dust collector shown separated from the body of the cleaner;

Figure 2 is an exploded view of the cyclone-type dust collector of the cleaner of Figure 1;

Figure 3 is a sectional view of the dust collector of Figure 2 in an assembled state;

Figure 4 is a sectional view of part of an alternative cyclone type-dust collector for a cleaner in accordance with the invention;

Figure 5 is a perspective view of a second upright-type vacuum cleaner having a cyclone type dust collector, in accordance with the invention;

Figure 6 is an exploded view of the cyclone type dust collector of the cleaner of Figure 5; and

Figure 7 is a sectional view of the dust collector of Figure 6, shown in an assembled state.

Referring to Figure 1, an upright-type vacuum cleaner in accordance with the invention includes a body 10 having a dust chamber 11 and a motor chamber (not shown), a suction brush or head 13 pivotally connected to the cleaner body 10. The cleaner further includes a cyclone type dust collector 15 that is removably disposed in the dust chamber 11.

The dust chamber 11 includes an air inlet 16a and an air outlet 17a formed in an inner wall thereof. The air inlet 16a is connected to a suction hose 16, which is connected to the suction brush 13. The air outlet 17a is connected to an exhaust hose 17 which is connected to the motor chamber.

The dust collector 15 separates and collects dust and contaminants from the air that is drawn in through the suction brush 13. For this purpose, the dust collector 15, as shown in FIGS. 2 and 3, includes a cover 20, a first cyclone receptacle 30, a second cyclone receptacle 40, a lower closure 50, and a reverse flow prevention portion.

The cover 20 is substantially disk-shaped and has a first air inlet 21 and an air outlet 23. The first air inlet 21 and the air outlet 23 are respectively formed on an edge part and a central part of the cover 20. Accordingly, when the cyclone type dust collector 15 is mounted in the dust chamber 11, the first air inlet 21 and the air outlet 23 of the cover 20 are connected with the air inlet 16a of the suction hose 16 and the air outlet 17a, respectively. Furthermore, an outlet pipe 25 is formed in the centre of the cover 20 and communicates with the air outlet 23.

The first cyclone receptacle 30 is substantially cylindrical in shape and has two open ends. The cover 20 is mounted on the open upper end of the first cyclone receptacle 30, while the lower closure 50 is mounted on the open lower end.

The first cyclone receptacle 30 and the cover 20 cooperate to draw air in through the first air inlet 21 and into a vortex which gives rise to a centrifugal force by which large particle contaminants are separated from the air. The first cyclone receptacle 30 may also be equipped with a handle 31.

The second cyclone receptacle 40 is also substantially cylindrical in shape over part of its length and has two open ends and tapered end portion. This second cyclone receptacle 40 is concentrically disposed within the first cyclone receptacle 30 and connected to the cover 20. The cylindrical portion of the second cyclone receptacle 40 comprises an outer body 41 in the form of a cylindrical wall having a grille with a plurality of fine holes 41a formed therein, through which air ascending in a reverse direction from the bottom of the first cyclone receptacle 30 passes. The second cyclone receptacle 40 also includes an inner body 43 in the form of a cylindrical wall coaxial with the wall of the outer body 41 and having a second air inlet 43a for guiding the air, which has passed through the fine holes 41a, into a vortex. There is a predetermined gap between the inner body 43 and the outer body 41.

The grille is formed on the outer body 41 with the fine holes 41a formed at a predetermined distance from each other. Since the fine holes 41a are formed discontinuously, the air does not flow into the second cyclone receptacle 40 while descending toward the bottom of the first cyclone receptacle 30.

It is preferable that the first and second air inlets 21 and 43a partially overlap each other.

The lower closure 50 is removably disposed at a lower end of the first cyclone receptacle 30 to allow disposal of the contaminants from the first and second cyclone

receptacles 30 and 40. In this embodiment, the lower closure 50 is screwed onto the first cyclone receptacle 30.

The reverse flow prevention portion prevents contaminants from flowing upwardly from the lower portions of the first and second cyclone receptacles 30 and 40. These reverse flow prevention means comprise an annular flange 33 which protrudes from an inner wall surface of the first cyclone receptacle 30, and a reverse flow prevention pipe 51 extending upwardly to a predetermined height from the centre of the lower closure 50.

The flange rib 33 slopes inwardly and downwardly from the inner circumference of the first cyclone receptacle 30 toward the lower closure 50, in order effectively to prevent contaminants from flowing upwardly from the bottom of first cyclone receptacle 30 along the inner circumference of the first cyclone receptacle 30.

The reverse flow prevention pipe 51 is formed in the centre of the second cyclone receptacle 40. By restricting the flow of minute dust particles collected in the second cyclone receptacle 40, the reverse flow prevention pipe 51 minimises the possibility of reverse flow of dust. Furthermore, the reverse flow prevention pipe 51 itself has a flange that extends radially outwardly from the upper circumference or edge of the reverse flow prevention pipe 51. This flange or sub-rib 53 hinders the flow of the minute particle dust from the second cyclone receptacle 40 along the outer circumference of the reverse flow prevention pipe 50. Flange 53 is downwardly inclined by a predetermined angle from the upper edge portion of the reverse flow prevention pipe 50.

Operation of the cleaner will now be described.

Firstly, the cleaner, with the cyclone type dust collector 15 installed, is turned on and the suction brush 13 draws in air, along with ambient dust and other contaminants, on and around the cleaning surface. This air flows through the suction hose 16 and air inlet 16a, to the first air inlet 21 of the dust collector 15. The cover 20 and first cyclone

receptacle 30 cooperate to induce the incoming air into a vortex which descends towards the lower closure 50. At this time, the larger particle contaminants are separated by the centrifugal force of the vortex and collected on the bottom of the first cyclone receptacle 30.

On reaching the bottom of the first cyclone receptacle 30, the vortex of air ascends. Some of the collected contaminants may rise adjacent the inner circumference of the first cyclone receptacle 30 with the ascending vortex of air. The rising contaminants are blocked by the inner flange 33, however, and fall back to the bottom of the first cyclone receptacle 30. As a result, the flange 33 improves the contaminant collecting efficiency of the first cyclone receptacle 30. Furthermore, since the flange rib 33 is inclined downwardly and inwardly towards the lower closure 50, the possible reverse flow of contaminants along the flange 33 is prevented.

As described above, the vortex of air rising from the lower closure 50, flows into the second air inlet 43a via the outer body 41. After flowing in through the second air inlet 43a, the air is guided in a diagonal or circumferential direction into a second vortex in the second cyclone receptacle 40. In the second cyclone receptacle 40, the minute particle dust is separated from the air by the centrifugal force of the second vortex, and falls to the bottom of the second cyclone receptacle 40. The second vortex of air, descending in the second cyclone receptacle 40 also rises after reaching the bottom. The ascending vortex of air in the second cyclone receptacle 40, reaches a defined space between the outlet pipe 25 and the reverse flow prevention pipe 51, and is drawn into the outlet pipe 25 by the different air pressures caused by different current velocities of upper and lower areas. The air in the outlet pipe 25 is then released through the air outlet 23.

Meanwhile, the lighter air, which reaches the centre of the second cyclone receptacle 40, also turns upwardly and directly ascends. In this embodiment, the reverse flow prevention pipe 51 is at the centre of the second cyclone receptacle 40, restricting any reverse flow or movement of dust collected in the second cyclone receptacle 40. Furthermore, any reverse flow of a few minute particles of dust is substantially blocked

by the flange 53 formed at the upper end of the reverse flow prevention pipe 51, and falls back to the bottom of the second cyclone receptacle 40. Here also, since the flange 53 is downwardly inclined at a predetermined angle, the minute particle dust is blocked more efficiently.

When the first and second cyclone receptacles 30 and 40 are full of dust and contaminants, the lower closure 50 may be opened to remove the dust and contaminants. In this embodiment, the lower closure 50 is removably screwed onto the first cyclone receptacle 30.

Figure 4 is a schematic sectional view illustrating an alternative cyclone-type dust collector for a cleaner in accordance with the invention. Since the basic structure of the dust collector is identical to that shown in FIGS. 2 and 3, like elements are given the same reference numerals. The cyclone type dust collector shown in Figure 4 includes a hinge shaft H which pivotally connects a side of the lower closure 60 to the first cyclone receptacle 30. Since the lower closure 60 is coupled to the first cyclone receptacle 30 via the hinge shaft H, the reverse flow prevention pipe 55 is supported on the bottom of the second cyclone receptacle 40 by a plurality of ribs or spokes 45.

This dust collector includes a locking/unlocking portion for locking or unlocking the other end of the lower closure 60 to or from the first cyclone receptacle 30. This locking/unlocking portion includes a locking groove 61 formed in the lower closure 60, a locking rod 71 movably disposed on a handle 31 of the first cyclone receptacle 30 to correspond to the locking groove 61, a first resilient member, e.g. a spring 72 for biasing the locking rod 71 in a direction where the locking rod 71 is inserted in the locking groove 61, and an unlocking unit 73 for removing the locking rod 71 from the locking groove 61 by overcoming the biasing force of the spring 72. It is preferred that the spring 72 is a compression coil spring disposed around the locking rod 71 to bias the locking rod 71 resiliently toward the locking groove 61.

The unlocking unit 73 includes an unlocking button 74 formed at one side of the handle 31 in a manner such that the unlocking button 74 enters or exits with respect to one

side, a second pressing member 75 for biasing the unlocking button 74 outwardly, a wire, cable or line 76 having one end connected to the locking rod 71, and a pivot member 77 pivotally disposed in the handle 31. The second pressing member 75 is a coil spring which is disposed around the unlocking button 74 to bias the unlocking button 74 resiliently outwards. It is also preferable that the wire 76 is an elastic member, such as an elastic string or a long coil spring. One end of the wire 76 is connected to the locking rod 71, and the other end is connected to one end of the pivot member 77. The other end of the pivot member 77 contacts the unlocking button 74. Accordingly, the centre of the pivot member 77 is pivotally supported in the handle 31.

The operation of the dust collector of Figure 4 will now be described. In order to open or close the lower closure 60, the user presses the unlocking button 74. When the unlocking button 74 is pressed into the handle 31, it presses one end of the pivot member 77 downwardly, while the other end of the pivot member 77 pivots upwardly. Simultaneously, the wire 76, which is connected to other end of the pivot member 77, also moves upwardly, pulling the locking rod 71. The wire 76 pulls the locking rod 71 to remove the locking rod 71 from the locking groove 61. As the locking rod 71 disengages from the locking groove 61, the weight of the lower closure 60 causes the lower closure 60 to pivot about the hinge shaft H, thereby opening the lower end of the first cyclone receptacle 30.

As described above, the dust collecting efficiency of the cyclone type dust collector is increased by preventing reverse flow of collected contaminants. Furthermore, the locking/unlocking portion enables a user to open and close the lower closure 60 more easily, thereby facilitating disposal of the contaminants that have collected in the dust collector.

Figure 5 shows another upright type vacuum cleaner 100 in accordance with the invention. The cleaner 100 includes a body 110 having a dust chamber 120 and a motor chamber 150, and a cyclone type dust collector 200 removably disposed in the dust chamber 120. A suction brush 130 is pivotally connected to a lower end of a vacuum cleaner body 110. The suction brush 130 is connected to a suction hose 140, which in

turn is connected to an air inlet 121 formed on a side of the dust chamber 120. The motor chamber 150 is interconnected with the dust chamber through an air outlet 122 formed in the bottom of the dust chamber 120.

The dust collector 200 separates by centrifugal force and collects contaminants from the air that is drawn in through the suction brush 130. As shown in FIGS. 6 and 7, such a dust collector 200 includes a first cyclone receptacle 210 which is substantially cylindrical and has two open ends, a second cyclone receptacle 220 concentrically disposed in the first cyclone receptacle 210, a cover 230, and a base 240. The cover 230 and the base 240 are respectively mounted on the upper and lower portions of the first cyclone receptacle 210. First, second, and third outlet pipes 251, 252, and 253, respectively, communicate with the air outlet 122 to interconnect the second cyclone receptacle 220 with the dust chamber 120 and the motor chamber 150.

According to the present invention, an annular rib 211 or flange protrudes from an inner circumference of the first cyclone receptacle 210 toward an axis thereof at a predetermined downwardly sloping angle. This annular rib is located approximately halfway between the top and bottom of the first cyclone receptacle 210.

Furthermore, a tube 231 is provided on a side wall of the cover 230 and interconnected with the air inlet 121 that is formed in the dust chamber 120. The tube 231 is connected to an inlet pipe 232, which extends a predetermined length along a ceiling and inner circumference of the cover 230 and which has a predetermined radius of curvature in order to guide the air into a vortex when the air flows through the inlet pipe 232.

A suction pipe 233 extends downwardly a predetermined depth from the centre of the ceiling of the cover 230 and into the second cyclone receptacle 220. The suction pipe 233 is interconnected with the first outlet pipe 251 and has a substantially funnel-like shape, in which a lower end of the suction pipe 233 extends radially outward, i.e. it has a flared end.

A connecting pipe 241 is provided in the base 240 and is connected to the third outlet pipe 253 and the motor chamber (not shown) through the air outlet 122 formed in the bottom of the dust chamber 120.

The second cyclone receptacle 220 has a substantially cylindrical upper side 221, a tapered sloping side 222 gradually decreasing in a diameter towards the lower end of the second cyclone receptacle 220, and a bottom wall 223 for covering the narrower end of the receptacle 220.

The cylindrical side 221 has a dual-layer structure in which an outer body having a plurality of fine holes 221a is formed therein in a predetermined pattern (i.e., a grille 221A), and an inner body 221B concentrically disposed within the grille 221A. An air outlet (not shown) is formed in the upper end of the inner body 221B. Further, an outlet pipe 224 extends along the inner body 221B, diagonally curving at a predetermined radius of curvature to induce the air from the air outlet into a vortex.

It is advantageous that the openings of the air outlet and outlet pipe 224 partially overlap the opening of the inlet pipe 232 of the cover 230. In addition, a reverse flow prevention pipe 225 extends upward a predetermined height from the centre of the bottom wall 223 of the second cyclone receptacle 220. The reverse flow prevention pipe 225 is a pipe member which has open upper end, and a lower end that is closed by the bottom side 223 of the second cyclone receptacle 220.

As shown in Figure 7, the reverse flow prevention pipe 225 is arranged in such a manner that the reverse flow prevention pipe 225 faces the funnel-shaped suction pipe 233 along the substantially same axis. Furthermore, the leading ends of the suction pipe 233 and the reverse flow prevention pipe 225 are spaced from each other by a predetermined distance to define a second space S2 therebetween.

In addition, as shown in Figure 6, the first, second, and third outlet pipes 251, 252, and 253 are integrally formed on the outer surface of the cover 230, the first cyclone receptacle 210, and the base 240, respectively, and are interconnected with each other to

form an outlet passageway. Although the first, second, and third outlet pipes 251, 252, and 253 are separately formed in this embodiment, the same can be replaced by a single pipe member.

In one variant, a portion of the second outlet pipe 252 is spaced from the first cyclone receptacle 210 (see Figure 6) to serve as a handle.

In operation of the cleaner described above with reference to Figures 5 to 7 air and dust and contaminants entrained in air drawn in through the suction brush 130 and the suction hose 140 passes through the air inlet 121, and into the tube 231 formed in the cover 230 of the cyclone type dust collector 200. As the air flows through the inlet pipe 232 of the cover 230 and into the space defined between the first and second cyclone receptacles 210 and 220, respectively, the air is induced into a vortex (indicated by the larger headed, solid line arrow in Figure 7). The air descends toward the bottom of the base 240. In this descending vortex of air, larger particle contaminants are separated from the air by centrifugal force and fall to the bottom of the base 240.

Next, the vortex of air descends in the space between the first and second cyclone receptacles 210 and 220 and ascends after reaching the bottom of the base 240. Here, dust and contaminants floating in the air are blocked by the reverse flow prevention rib or flange 211, and fall back onto the bottom of the base 240.

When the vortex of air, rising from the bottom of the base 240, reaches the grille 221A of the second cyclone receptacle 220, the air flows into the first space S1 defined between the grille 221A and the inner body 221B through the plurality of fine holes 221a. Here, the contaminants are filtered once more, i.e., the large particles of the contaminants in the air are filtered out by the fine holes 221a.

After flowing through the fine holes 221a into the first space S1 between the grille 221A and inner body 221B, the air flows into the second cyclone receptacle 220 through an air outlet (not shown) formed on the upper end of the inner body 221B. The outlet pipe 224 is interconnected with the air outlet. While flowing into the second

cyclone receptacle 220, the air is circumferentially guided by the outlet pipe 224 and induced into a vortex (indicated by the smaller headed, solid line arrow in Figure 7) around the inlet pipe 233 of the cover 230 and the reverse flow prevention pipe 225 of the second cyclone receptacle 220, sequentially.

Accordingly, dust is separated from the air by centrifugal force and falls to the bottom of the second cyclone receptacle 220.

Meanwhile, the descending vortex of air rises when it reaches the bottom side 223 of the second cyclone receptacle 220. In such a situation, floating dust and contaminants in the ascending air (indicated by the smaller headed, dotted line arrow in Figure 7) are blocked by the rib 220a protruding from the inner circumference of the second cyclone receptacle 220 and fall back to the bottom side 223 of the second cyclone receptacle 220. The ascending vortex of air reaches the second space S2, defined between the inlet pipe 233 of the cover 230 and the reverse flow prevention pipe 225 of the second cyclone receptacle 220. Air is drawn directly from the second space S2 into the inlet pipe 233 as a result of the different pressures caused by different flow velocities of the air in the upper and lower regions of the second space S2. The air that has been drawn into the inlet pipe 233 (indicated by the short straight arrows in Figure 7) is exhausted through the first, second, and third outlet pipes 251, 252, and 253, exhaust port 122, and the motor chamber 150.

The contaminants collected in the first and second cyclone receptacles 210 and 220 can be removed by separating the base 240 from the first cyclone receptacle 210 and disposing of the contaminants contained therein.

As shown in Figure 7, the base 240 and the first cyclone receptacle 210 have threads, respectively, which are complementary to each other, enabling the base 240 to be secured to the first cyclone receptacle 210. In the alternative, the base 240 and the first cyclone receptacle 210 may be connected together other by a plurality of fastening methods.

As described above, an the upright type vacuum cleaner having a cyclone type dust collector as described above, minute dust particles and larger particle contaminants are systematically separated from the air based on their sizes. Since the cyclone type dust collector effects a filtering process that prevents a reverse flow of dust and contaminants, the cleaning performance and efficiency of the vacuum cleaner are greatly improved.

By integrally forming the outlet pipe on the cyclone type dust collector, the vacuum cleaner body can be more compact. In addition, due to the detachable structure of the cyclone type dust collector, the dust and contaminants collected in the cyclone type dust collector can be disposed of more easily.

## CLAIMS

1. An upright type vacuum cleaner comprising:

a body having a dust chamber and a motor chamber;

a suction brush connected to the body;

cyclone type dust collecting means removably disposed in the dust chamber, for separating and collecting contaminants from air that is drawn in through the suction brush, the cyclone type dust collecting means comprising:

a cover having a first air inlet connected to a suction hose, the suction hose being connected to the suction brush and the dust chamber, the cover also having an air outlet connected to an exhaust hose, the exhaust hose being connected to the dust chamber and the motor chamber;

a first cyclone receptacle connected to the cover and arranged to induce the air into a vortex to separate by centrifugal force and collect larger particle contaminants from the air;

a second cyclone receptacle disposed in the first cyclone receptacle, the second cyclone receptacle being connected to the cover and having a grille which has a plurality of fine holes for admitting therethrough air from a bottom part of the first cyclone receptacle, the second cyclone receptacle further including a second air inlet for guiding the air from the fine holes of the grille into a vortex;

a lower closure removably mounted on an open lower end of the first cyclone receptacle, the closure permitting disposal of contaminants from the first and second cyclone receptacles; and

reverse flow preventing means for preventing a reverse flow of contaminants from the lower closure.

2. A cleaner according to claim 1, wherein the reverse flow preventing means comprise an annular main rib protruding from an inner circumference of the first cyclone receptacle.

3. A cleaner according to claim 2, wherein the reverse flow preventing means further comprises a reverse flow prevention pipe protruding from a lower central portion of the second cyclone receptacle, the reverse flow prevention pipe having an annular sub-rib protruding from an outer circumference thereof for preventing a reverse flow of contaminants.

4. A cleaner according to claim 3, wherein the sub-rib extends integrally from an upper end of the reverse flow prevention pipe in a radial direction, the sub-rib being downwardly inclined towards the lower closure.

5. A cleaner according to any of claims 2 to 4, wherein the main rib is downwardly inclined towards the lower closure.

6. A cleaner according to any preceding claim, wherein the grille comprises a plurality of fine holes formed in an outer circumference of the second cyclone receptacle, each fine hole being formed at a predetermined distance from adjacent fine holes.

7. A cleaner according to any preceding claim, further comprising:

a hinge shaft for pivotally connecting a side of the lower closure to a lower side of the first cyclone receptacle; and

locking and unlocking means for locking and unlocking another side of the lower closure to and from the first cyclone receptacle.

8. A cleaner according to claim 7, wherein the locking and unlocking means comprises:

locking groove on the lower closure;

a locking rod movably disposed in the first cyclone receptacle to engage and disengage from the locking groove;

a first pressing member for biasing the locking rod towards the locking groove; and

an unlocking device for retracting the locking rod from the locking groove, the unlocking device overcoming a force of the first pressing member.

9. A cleaner of claim 8, wherein the unlocking device comprises:

an unlocking button disposed on a side of the first cyclone receptacle;

a second pressing member for biasing the unlocking button outwardly;

a wire having a first end and a second end, the first end being connected to the locking rod; and

a pivot member having a first end and a second end, the first end of the pivot member being connected to the second end of the wire, the second end of the pivot member being connected to the unlocking button, the pivot member and the wire disengaging the locking rod from the locking groove when the unlocking button is depressed.

10. A cleaner according to claim 8 or claim 9, wherein the locking and unlocking means are disposed in a handle on an outer circumference of the first cyclone receptacle.

11. An upright type vacuum cleaner comprising:

a body having a dust chamber and a motor chamber;

a suction brush connected to the vacuum cleaner body and interconnected to the dust chamber through a connecting tube;

cyclone type dust collecting means removably disposed in the dust chamber for separating and collecting foreign substances from air that is drawn in through the suction brush, the cyclone type dust collecting means comprising:

a substantially cylindrical first cyclone receptacle having open upper and lower ends;

a second cyclone receptacle concentrically disposed within the first cyclone receptacle with a predetermined space therebetween, the second cyclone receptacle having open upper and lower ends;

a cover for covering the upper ends of the first and second cyclone receptacles;

a base for covering the lower ends of the first and second cyclone receptacles; and

an air exhaust pipe for interconnecting the second cyclone receptacle and the motor driving chamber.

12. The vacuum cleaner of claim 11, wherein the cyclone type dust collector further comprises an annular reverse flow prevention rib protruding from an inner circumference of the first cyclone receptacle towards a central axis at a predetermined angle of inclination.

13. A cleaner according to claim 12, wherein the reverse flow prevention rib is downwardly inclined toward the base.

14. A cleaner according to any of claims 11 to 13, wherein the cover comprises:

a tube provided along the inner circumference of the dust chamber, and interconnected with a connecting channel, the connecting channel being connected to the dust chamber;

an inflow pipe radially extending a predetermined distance along a ceiling and an inner circumference of the cover, and interconnected with the tube; and

a suction pipe protruding a predetermined depth from a centre of the cover, the suction pipe being interconnected with the exhaust pipe.

15. A cleaner according to claim 14, wherein the suction pipe has a funnel-like shape, in which a free end of the suction pipe extends radially from the suction pipe, gradually increasing a diameter of the suction pipe.

16. A cleaner according to any of claims 11 to 15, wherein the second cyclone receptacle is substantially cylindrical in shape and has a planar upper side of, a tapered side gradually decreasing diameter of the cylinder, and a bottom side for covering one end of the cyclone receptacle, the plane upper side having a dual structure formed of an outer body having a plurality of fine holes uniformly formed therein, and an inner body disposed within the outer body at a predetermined distance from the outer body, the bottom side having a guiding tube extending a predetermined distance from the centre of the second cyclone receptacle.

17. A cleaner according to claim 16, further comprising an air outlet formed in an upper end of the inner body of the second cyclone receptacle, the air outlet having an opening partially overlapping an opening of the inflow pipe of the cover.

18. A cleaner according to claim 17, further comprising a guide tube radially extending in a diagonal direction for inducing air from the air outlet into a vortex.

19. A cleaner according to any of claims 11 to 18, wherein the exhaust pipe comprises a first exhaust sub-pipe formed on the outer surface of the cover, a second exhaust sub-pipe formed on an outer surface of the first cyclone receptacle, and a third exhaust sub-pipe formed on an outer surface of the base, the first, second and third exhaust sub-pipes being interconnected.

20. A cleaner according to claim 19, wherein the second exhaust sub-pipe is spaced from the first cyclone receptacle to form a handle.

21. A cleaner according to any of claims 11 to 20, wherein the base is removably connected to the first cyclone receptacle.

22. A cleaner according to any of claims 11 to 15, wherein the second cyclone receptacle comprises an upper part having spaced apart coaxial inner and outer cylindrical walls, the outer wall being perforated by a plurality of fines holes to form a grille, and, connected to the upper art, a lower part having a generally coaxial wall tapering in the downward direction, a bottom wall in the form of a cover connected to the narrower end of the lower part, and a guide tube extending axially from the bottom wall into the receptacle interior by a predetermined distance.

23. An upright-type vacuum cleaner constructed and arranged substantially as herein described and shown in the drawings.

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**Application No:** GB 0104824.8 **Examiner:** Nicholas Mole
**Claims searched:** 11-22 **Date of search:** 13 August 2001

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# Further Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B2P (P10B2A3, P10B2B, P10B2C) A4F FFD

Int Cl (Ed.7): A47L 9/16 B04C 5/26

Other: Online: WPI EPODOC JAPIO

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | | Relevant to claims |
|---|---|---|---|
| Y | GB 2317122 A | (NOTETRY) see esp. figures | 11, 19, 21 at least |
| Y | EP 0923992 A | (NOTETRY) see col. 4 para 15 | 11, 19, 21 at least |
| Y | EP 0728435 A | (BLACK & DECKER) see figure 3 | 11, 19, 21 at least |
| Y | EP 0134654 A | (ROTORK) see esp. figure 4 and page 10 line 22 to page 11 line 21; page 13 line 13 to page 15 line 24 | 11, 19, 21 at least |
| Y | US 5145499 | (DYSON) see esp. figures 1,2 and 5 and col. 11 lines 28-57 | 11, 21 at least |
| Y | US 4853008 | (DYSON) see esp. figure 1 and col. 3 lines 22-56 | 11, 19, 21 at least |

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**Application No:** GB 0104824.8
**Claims searched:** 1-10
**Examiner:** Nicholas Mole
**Date of search:** 3 May 2001

# Patents Act 1977
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**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B2P (P10B2A3, P10B2B, P10B2C, P1A) A4F FFD

Int Cl (Ed.7): B04C 5/26 A47L 9/16

Other: Online: WPI EPODOC JAPIO

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | | Relevant to claims |
|---|---|---|---|
| Y | GB 2296879 A | (NOTETRY) See Fig 1 and Page 3 line 5 - page 5 line 26 | 1 at least |
| Y | EP 0923992 A | (NOTETRY) See col. 4 para 15 | 1 at least |
| Y | EP 0728435 A | (BLACK & DECKER) See Fig 3 | 1 at least |
| Y | EP 0636338 A | (NOTETRY) See Fig 2 and Col. 3 line 23 - col. 6 line 16 | 1 at least |

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